KLH ENGINEERS

Mechanical, Electrical, and Plumbing Condition Assessment of the City of Taylor Mill, Fire Station Building #1

Prepared for
CT Consultants, Inc.

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Executive Summary

The purpose of this report is to provide input regarding existing conditions noted during site observations of the City of Taylor Mill Fire Station #1 building, located at 5225 Taylor Mill Road, Taylor Mill, Kentucky. The original building (offices, living areas and support areas) was constructed in 1978, and the attached PEMB bay building was subsequently added. The collective facility continues to operate today.

During the month of December of 2020, KLH Engineers performed a preliminary site observation review of the existing facility. The information provided herein is a summary of the KLH Engineers' initial findings noted during the site visit.

Figure 1 - Aerial view of the City of Taylor Mill Buildings
(Administration/Police in foreground, Fire Station in middle, Public Works in background)

Mechanical

General

Summary

The block office/living building is served by two (2) gas-fired, 3-ton, ducted split system AC units for heating and air conditioning. These systems are supplemented with electric-resistance baseboard and wall heaters in perimeter and entry areas. Small exhaust fans exist as needed for rooms such as shower areas and toilet rooms, however, there is no dedicated vehicle exhaust system in the Apparatus Bay. All systems are dated and are either past or approaching the end of their expected useful lives. The owner should consider replacements of some of the equipment components as soon as possible, particularly those that have been exposed to water damage from structural roof and exterior wall leaks.

Figure 2 - Split-System AHU located on Upper Level

Figure 3 - Split-System AHU located on Lower Level

Tag	Mfr.	Model	Year	Years Remaining	Condition
AHU-1	Goodman	GMP100-4	1995	0	Fair
AHU-2	York	WHMM022355	2003	0	Fair

Figure 4 - Split-System AC Condensing Units

Figure 5 - Split-System AC Condensing Unit Tag (R-22)

Tag	Mfr.	Model	Year	Years Remaining	Condition
CU-1	York	H4DB036S06A	2005	0-1	Fair
CU-2	York	H4DB036S06A	2003	0	Fair

Recommendations / Issues of Interest

a) **Air Handling Units / Condensing Units:** The AHU / CU equipment is operational, however, the age of the equipment is either at or past ASHRAE's median service life expectancy. Furthermore, the existing units utilize R-22 refrigerant, which has been phased out of U.S. production starting in 2020. Obtaining this refrigerant for any potential repairs will become increasingly expensive as the available refrigerant supply depletes until it is no longer available.

Recommendation:
The useful service life expectancy of both the air handling units / furnaces and the air-cooled condensing units have been exceeded. It is recommended that the equipment be inspected by a qualified HVAC contractor and suggest that the city administration consider a planned replacement of the equipment before failure occurs.

b) **Supplemental Heaters:**
Building personnel noted that the existing wall heaters have not been in operation for some time. The age of the equipment was not readily apparent, however, they appear to original to the building.

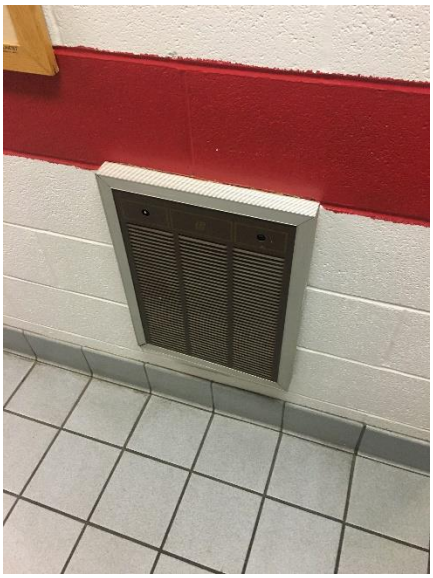

Figure 6 - Electric Wall Heater located on Lower Level

Figure 7 - Baseboard Heater located in Lower Level Men's Locker Room

b) Supplemental Heaters (Cont.):

Additionally, the electric baseboard heater in the lower-level Men's Locker Room has been turned off due to building water infiltration on the wall on which it is mounted. In addition to the potential equipment damage, the structural water infiltration creates an unsafe condition as it pertains to electric-powered heat.

Recommendation:

The heaters were all off and operation could not be confirmed. Also, if the heaters were installed when the building was constructed, then the useful service life expectancy of the equipment has been exceeded**.** It is recommended that the equipment be inspected by a qualified electrical contractor and suggest that the city administration consider a planned replacement of the equipment.

Opinion of Probable Cost

The estimated construction cost (rough order of magnitude) for one-for-one HVAC equipment replacement is a range of $55,000 - $65,000. *Excludes any incidental costs associated with repair and/or replacement of ceilings and wall penetrations that may be required with this system type.*

Plumbing

General

Summary

The block office/living building is served by two (2) electric, 80-gallon, water heaters for domestic hot water service. The plumbing fixtures appear to be residential grade, and with the exception of the urinal, all have manually operated valves / flush valves. The urinal located in the lower level Men's Locker Room has an automatic flush valve, and building personnel noted that it has been replaced several times. None of the plumbing fixtures appeared to be "low-flow" rated devices. Regarding the building sanitary drainage, there was a prior issue noted by building personnel that caused a backup in the lower level Women's Locker Room. There have been no subsequent backups, but further line scoping / investigation may be warranted.

Figure 8 - Water Heater located in Lower Level Furnace Rm.

Figure 9 - Water Heater located in Lower Level Janitor Closet

Tag	Mfr.	Model	Year	Years Remaining	Condition
DWH-1	US/Craftmaster	E2F80HD045V	2000	0	Fair
DWH-2	Bradford White	M280R6DS-1NCWW	2009	0-2	Fair

Figure 10 - Sink located in Lower Level Men's Rm. (Typical)

Figure 11 - Upper Level Kitchen Area, w/Sink and Dishwasher

Recommendations / Issues of Interest

a) **Domestic Water Heaters:** The typical useful service life expectancy of electric water heaters is eight to twelve years. So, based upon the heater manufacturing and installation dates, both of the heaters are past or nearing the end of their expected service life.

Recommendation:
It is recommended that the equipment be inspected by a qualified plumbing contractor and suggest that the city administration consider a planned replacement of the equipment before failure occurs.

b) **Plumbing Fixtures / Sanitary Piping:**
With the exception of the issue noted with the urinal flush valve, the fixtures appear to be in acceptable working order. Regarding the sanitary piping, please refer to the general summary, above, for previous issue noted in Women's Locker Room.

Recommendation:
Fixtures: No additional recommendation for replacements at this time. However, the city administration may wish to consider upgrading to new water efficient valves / fixtures. ***Sanitary:*** It is recommended that the sanitary piping system be inspected / scoped by a qualified plumbing contractor, and that the service cleanout locations be identified.

Opinion of Probable Cost

The estimated construction cost (rough order of magnitude) for domestic water heater replacement and sanitary system scoping is $20,000.

Fire Protection

General

Summary

The facility does not contain a fire suppression system.

Opinion of Probable Cost

Should a fire suppression system be added, estimated construction cost (rough order of magnitude) is a range of $65,000 - $75,000. Cost range includes new meter pit and tap fee, if required by local utility. *Excludes any incidental costs associated with repair and/or replacement of ceilings and wall penetrations that may be required with this system type.*

Electric – Power Distribution and Branch Circuiting

General

Summary

General Conditions: Electrical work installed in the past +/- 5 years appears to be in good working order. Overall condition of other electrical work appears to be in fair to poor condition. There are many instances of electrical work being installed piecemeal to accommodate evolving fire department needs over the past 40+ years. Some of this added work was installed using means and/or methods that are not compliant with prevailing codes. There are numerous instances where receptacles do not exist where they are needed based on current needs. Some areas where electrical panelboards are installed are also being used for storage. Proper working clearance of 30 inches wide and 36 inches deep in front of the panels, as defined by the National Electric Code (NEC), is not always being maintained. This should be resolved immediately. Electrical work has been exposed to water damage to some degree over the years from roof leaks. It appears that some associated remedial work has taken place.

Electric Utility Service: The fire station is fed from a pole-mounted utility transformer bank at 208Y/120V, three-phase, 4-wire, 400-ampere. The service appears to be in good working order.

Electric Standby Power Service: A standby 125-kilowatt (kW) diesel generator set was installed in 2015 to provide backup power for the Fire Station, the City/Police Building and the Public Works building. The automatic transfer switch (ATS) is located at the southeast corner of the Fire Station apparatus bay building. The ATS automatically transfers power from utility to generator during a utility power outage, and from generator back to utility when utility power is restored. The ATS feeds a power distribution panel (also installed in 2015), which feeds the Fire Station, the City/Police Building and the Public Works Building. Please note that the ATS and main power distribution panel was installed above the preexisting incoming water service for the building, presumably because there were no other practically feasible options at the time.

Electric Power Distribution: Electric power is distributed from the main power distribution panel (next to the ATS) to various smaller circuit breaker panelboards. Most of the downstream residential/light commercial grade panelboards are decades old and may not be rated to withstand the available utility fault current. Such ratings ensure breakers will trip when there is a short circuit condition faster than the inrush current will damage or destroy them.

Branch Circuit Wiring and Cabling: The programmatic needs of the fire department have greatly outgrown the originally installed electrical branch circuiting. Electrical work has been added over time to keep up with evolving needs. Some of this added work was installed in a manner non-compliant with prevailing codes. Many of these instances involve means and methods used for installing cables (i.e.

improper anchoring and applications). Also, water from past roof leaks may have intruded into the cable jackets, which can deteriorate the integrity of the cable assemblies.

Wiring Devices: Wiring devices include general switches, receptacles, etc. The majority of the wiring devices are in fair to poor condition, many of which appear to be original to the buildings. Some wiring devices, or at least their outlet boxes, have sustained some water damage from past roof leaks.

Figure EP1 - Example of aging/water damage

Figure EP2 - Example of trying to mitigate water damage

Figure EP3 - Electric utility service

Figure EP4 - Electric utility service

Figure EP5 - Diesel generator set behind bay building

Figure EP6 - ATS and main distribution panel

Figure EP7 - Example of existing panelboard

Figure EP8 - Example of existing panelboard

Figure EP9 - Example of existing panelboard

Figure EP10 - Water service entrance beneath Generator ATS

Figure EP11 - Example of outgrowing receptacle quantities

Figure EP12 - Example of outgrowing receptacle quantities

Figure EP13 - Example of outgrowing receptacle quantities

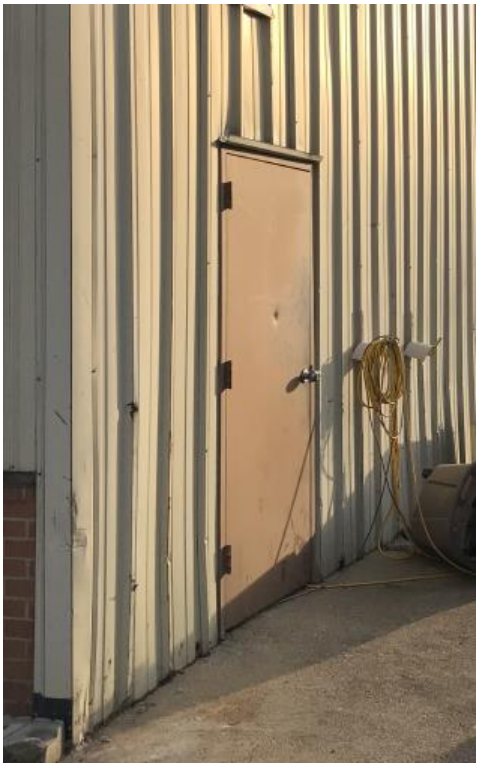

Figure EP14 - Example of outgrowing receptacle quantities

devices, or at least their outlet boxes, have sustained some water damage from past roof leaks.

Figure EP15 - Example of improperly installed cables

Figure EP16 - Example of improperly installed cables

Recommendations / Issues of Interest

a) **General Conditions:** All existing electrical work should be inspected in detail to determine and document the true degree of damage that may have been caused from roof leaks over time. Any conditions that still warrant repairs or replacements should be addressed.

b) **Electric Utility Service:** The electric utility service seems to be adequate for current needs but may need to be increased in the future if significant electrical loads are added.

c) **Electric Standby Power Service:** The standby generator system appears adequate for current needs. Action should be taken to protect the automatic transfer switch and the adjacent power distribution panel and panelboard from serious water damage in the event a leak occurs at the valve or in the piping. The standby generator system may need to be expanded in the future if significant electrical loads are added. If the city outgrows the capacity of the generator over time, service and generator upgrade work will be needed. One option may be to dedicate the generator to the Fire Station and provide dedicated generators for the two other buildings. Another option may be to serve the Fire Station and Public Works buildings with the existing generator and provide a new generator for the City/Police building. The future load profiles will largely dictate the appropriate solution.

d) **Electric Power Distribution:** An electric Power Distribution Study should occur. Included would be developing a true as-built technical single-line diagram that shows how power is distributed and at what loads and ratings. Also included should be a Fault Current report that will identify which panelboards are and are not properly rated to withstand a fault (short circuit) with circuit breakers expected to successfully operate. Some or all of the panelboards downstream from the main distribution panel should be replaced based on general age/condition and based on the outcome of the Power Distribution Study.

e) **Branch Circuit Wiring and Cabling:** Damaged and aged branch circuit wiring should be identified and replaced. Existing conduits that are in good order can be reused wherever possible. All electrical work that was installed since the building were constructed should be closely reviewed and work not complying with NEC should be replaced using code-compliant means, methods and materials. All branch circuit power and communications cables that remain should be reviewed to ensure they are all installed using anchorage and supports that are not shared with other systems (i.e. they should not be strapped to conduit, equipment, etc. – they should have independent supports directly to structural elements). Power sources for the bay area overhead reel-cords should be checked to ensure they are fed from ground fault interrupter circuit interrupter (GFCI) type circuit breakers. Ground fault circuit interrupter protection should be reviewed for all applications required under NEC and GFCI protection should be provided for all instances where it does not already exist. All circuiting serving all living areas should be provided with arc-fault protection at each associated source circuit breaker. This will prevent an arcing condition inside an outlet box (or in cords, etc.) from starting a fire. Such arc-faults can create a great deal of heat without drawing enough current to trip a normal breaker.

f) **Wiring Devices:** Each wiring device should be inspected for integrity and proper ratings. Those that are found defective, overly-aged, water damaged, underrated, etc. should be replaced with properly rated specification-grade devices and new cover plates suitable for the respective environment. Any defective outlet boxes should be replaced when found.

Opinion of Probable Cost

The estimated opinion of probable construction cost (rough order of magnitude) for electrical power system upgrades is as follows:

a) Electric Power Distribution Study with Report & Single-Line Diagram	$ 9,600.00
b) Electric Power Distribution Upgrades	$30,000.00
c) Branch Circuit Wiring and Cabling Upgrades	$30,000.00
d) Wiring Device Upgrades	$ 9,400.00
Total	$79,000.00

Electric – Lighting Systems

General

Summary

General Conditions: Aside from the more recently installed luminaires, most of the lighting fixtures are at or near the end of their useful life. Additionally, there may be existing water damage to at least some of the lights as a result of numerous past roof leaks. As a side note, the lighting industry has moved away from incandescent, fluorescent and HID sources to efficient integrated-LED technology.

Apparatus Bay and Turnout Gear Room Lighting: The Apparatus Bay and TOG lights are fluorescent high-output/high-efficiency replacements for the original lights. They appear to be in good working order.

Remaining Interior Lighting: The overall lighting in the remainder of the building is served by linear and point-source fluorescent luminaires/lamps, along with some retrofit LED sources. Most of these lights are near the end of their useful life.

Emergency Exit/Egress Lighting: Emergency egress lighting is provided by battery-operated fixtures and accessories that automatically illuminate upon loss of power to the normal circuit that powers lighting in a given area. Exit signage throughout the building appears to be battery-operated and appropriately placed. Even though the building has generator backup, the battery-backup style exit signs and "bug-eyes" are still required by prevailing codes. The generator system is wired as an Optional Standby system under the National Electrical Code. There is no Emergency Branch of power, which would require a dedicated output breaker at the generator set, dedicated automatic transfer switch, and dedicated wiring/systems within the building to power the affected luminaires.

Outdoor Lighting: Exterior lighting is achieved using outdated high-intensity discharge (HID) building-mounted and pole-mounted flood lights and general area lights. Some outdoor lighting has been added over time to supplement the original conditions. These styles are prone to introducing glare and undesirable lighting onto adjacent properties. Some of the lights are approaching the end of their useful life.

Lighting Controls: Although there are some automated controls (photocells, occupancy sensors), most of the lighting is controlled manually as was common 40+ years ago.

Figure EL1 - Typical Office/Living Area Lighting

Figure EL2 - Typical Office/Living Area Lighting

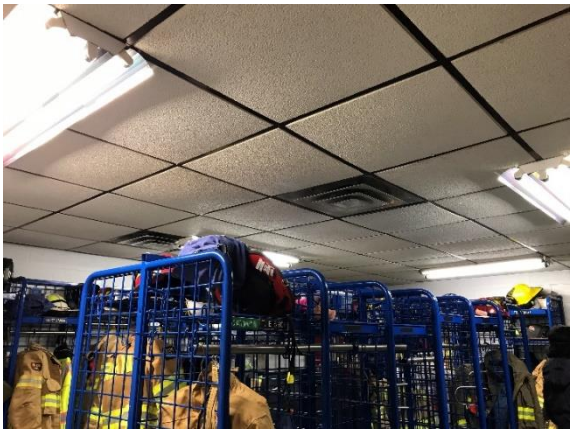

Figure EL3 - Turnout Gear Lighting

Figure EL4 - Apparatus Bay Lighting

Figure EL5 - Outdoor Lighting Example

Figure EL6 - Outdoor Lighting Example

Figure EL7 - Outdoor Lighting Example

Figure EL8 - Outdoor Lighting Example

Recommendations / Issues of Interest

a) **Apparatus Bay and TOG Room Lighting:** Lighting in these areas is relatively new when compared to the rest of the facility. When they are replaced, KLH recommends installing integrated-LED luminaires, selected and located optimally for quality uniform illumination. Please note that exposure of turn-out gear to ultraviolet spectrums of light can degrade the gear over time. Consideration should be given to expediting the replacement of the fluorescent lights in the TOG room with LED lights.

b) **Remaining Interior Lighting:** The existing lights are aged and are not providing adequate light quantity, quality and distribution in many spaces. KLH recommends replacing all interior lighting with integrated-LED luminaires, which will have longer life expectancies, lower energy usage, brighter and more uniform illumination and inherent dimming capabilities.

c) **Emergency Exit/Egress Lighting:** Batteries in these types of lights and signs typically last between 3 and 7 years depending on battery and environmental variables. As these fixtures are replaced, integrated-LED luminaires should be installed.

d) **Outdoor Lighting:** The site should be collectively studied, and a plan developed to replace all existing luminaires with new integrated-LED luminaires. The new lights should include full-cutoff optics, which are easier on the eyes and minimize introduction of glare on adjacent properties. Placement, mounting heights and distribution optics should be selected for optimal functionality and security needs along with ideal light distribution, while minimizing luminaire quantities and light spill. This recommendation includes some new lighting standards with one or two luminaires per pole.

e) **Lighting controls:** KLH recommends upgrading the lighting controls throughout the building to include a broader use of occupancy and vacancy sensors, and to include dimming controls for spaces as recommended by prevailing energy codes and functional use of spaces. This will allow for lower energy usage, longer luminaire life and increased flexibility for the building occupants. Similarly, controls for outdoor lighting should be upgraded to ensure none of them operate during periods when they are not actually needed. This is generally achieved using photocell control to ensure no outdoor lighting operates when daylight is available, coupled with zoned time-of-day control to differentiate which lights are selected for dusk-to-dawn operation vs. which come on at dusk and turn off at programmed times after dark instead of being on all night.

Opinion of Probable Cost

The estimated opinion of probable construction cost (rough order of magnitude) for the lighting and control systems is as follows. The figures are based on minimal reworking of circuit conductors that exist in the respective rooms/areas.

a)	Apparatus Bay and TOG Room Luminaires	$18,000.00
b)	Remaining Interior Luminaires	$24,000.00
c)	Emergency Exit/Egress Luminaires	$12,000.00
d)	Outdoor Luminaires	$36,000.00
e)	Lighting Controls	$20,000.00
	Total	$110,000.00

Fire Alarm System

General

Summary

The facility is not equipped with a central comprehensive fire alarm system. There are various stand-alone (some may be tandem wired) fire alarm and carbon monoxide (CO) devices installed.

Figure FA1 - Smoke alarm unit (high) & CO alarm unit (low)

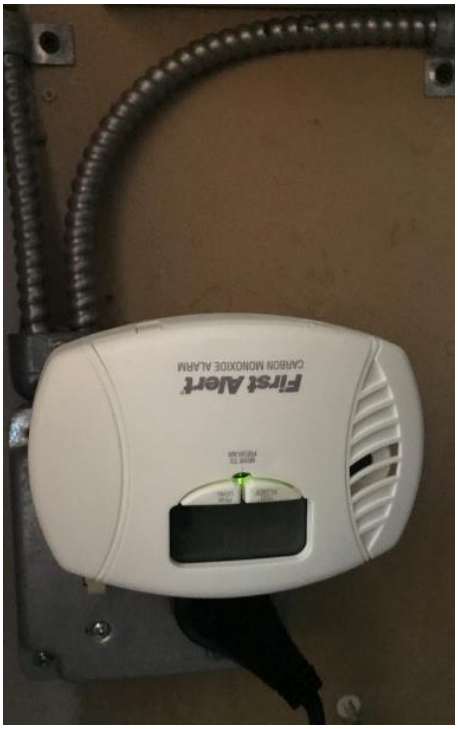

Figure FA2 - CO alarm unit

Recommendations / Issues of Interest

A central system would include smoke detection, heat detection, monitored CO detectors, manual pull stations, notification appliances (horn/strobes) throughout, battery and generator backup and digital communicator to a Central Station monitoring facility and to selected phone numbers in the event of a fire. Such a new system would not be zoned, it would be fully addressable with each alarm-initiating device assigned a unique address and annunciation. A new state-of-the-art system could also be used to help educate fire fighters on how contemporary systems operate.

Opinion of Probable Cost

The estimated opinion of probable construction cost (rough order of magnitude) for providing a new code-compliant addressable fire alarm system is $25,000.00.

End of MEP Assessment Summary Report